

## REMARKS

Claims 1-28, all the claims pending in the application, stand rejected on prior art grounds.

Claims 1, 10, 11, 19, 20, and 25 are amended herein. Applicants respectfully traverse the rejections based on the following discussion.

### **I. The Objection to the Specification**

The Office Action rejects the title as not being descriptive. Applicants herein amend the title to "MAGNETIC-FIELD SENSOR DEVICE HAVING MAGNETIC NANOPARTICLES AND A METHOD OF FORMING THE SAME". As such, the amended title is clearly indicative of the invention to which the claims are directed.

### **II. The Objections to the Drawings**

The drawings are objected to by the Draftsperson under 37 C.F.R. § 1.84 or § 1.152. Moreover, the Office Action states that "[t]his application has been filed with informal drawings, which are acceptable for examination purposes only." However, Applicants note that formal drawings were submitted on May 8, 2002 and received by the USPTO on May 20, 2002. A copy of return receipt postcard is included as prima facie evidence of such filing as well as the accompanying formal papers relating to the submission of the formal drawings. However, in an effort to move the prosecution along, a duplicate copy of the formal drawings is submitted herewith, and acknowledgment of receipt of said drawings would be appreciated. Therefore, the Examiner is respectfully requested to reconsider and withdraw this objection.



### **III. The Claim Rejections**

#### **A. The Prior Art Rejections under 35 U.S.C. § 103(a)**

Claims 1-28 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Black et al. (United States Patent No. 6,162,532), hereinafter referred to as "Black" in view of Inomata et al. ("Spin-dependent tunneling through layered ferromagnetic nanoparticles", Applied Physics Letters, Volume 73, No. 8, Aug. 24, 1998, pages 1143-1145)), hereinafter referred to as "Inomata".

Confusingly, the Office Action states that Black discloses a magnetic-field sensor device and a method as shown in Figs. 1-7 comprising: two electrodes 4B and 4C of Figs. 4-5, an insulating layer 7B of Fig. 5 separating the two layers; and one layer of chemically-synthesized magnetic nano-particles 1 of Fig. 5 located between the layers. However, the Office Action then states the opposite, that Black lacks in showing two electrode layers and magnetic-nano-particles located between the two electrode layers. Nonetheless, the Office Action cites Inomata as showing these two electrode layers with the magnetic-nano-particles located between the two electrode layers as shown in Fig. 1 (page 1144, line 7-50). As such, the Office Action concludes it would have been obvious to one having ordinary skill in the art at the time the invention was made to include this type of configuration structure of Inomata in the magnetic nano-particle sensor system in Black to provide an accurate efficient and high impedance sensitivity magnetic nano-particle structure device for detecting a magnetic field.

Thus, if the Office Action is correct that Black discloses a magnetic-field sensor device and a method as shown in Figs. 1-7 comprising: two electrodes 4B and 4C of Figs. 4-5, an



insulating layer 7B of Fig. 5 separating the two layers; and one layer of chemically-synthesized magnetic nano-particles 1 of Fig. 5 located between the layers, then it is functionally complete, and as such it would be unobvious to combine Inomata with Black in the manner suggested by the Office Action because of the redundancy of the structures, which are functionally complete in and of themselves. Thus, the 35 U.S.C. § 103(a) rejection is both improperly applied and incorrect in its assertion.

However, if the Office Action means that Black lacks in showing two electrode layers and magnetic-nano-particles located between the two electrode layers, and that it would be obvious to combine Inomata with Black to try and teach the present invention, then it is with this rejection with which the Applicants respond hereto. As such, the Applicants respectfully traverse the rejections for the following reasons.

#### **B. The Black Reference**

Black teaches a magnetic storage medium which is formed from a layer of substantially uniformly spaced-apart magnetic nanoparticles of substantially uniform diameter disposed upon a surface of a substrate, with a coating, preferably of abrasion-resistant material, applied to adhere the nanoparticles to the substrate and to maintain their substantially uniform spaced-apart relationship. The nanoparticles are formed from a magnetic material selected from the group consisting of elements Co, Fe, Ni, Mn, Sm, Nd, Pr, Pt, Gd, and intermetallic compound of the aforesaid elements, a binary alloy of said elements, a ternary alloy of said elements, an oxide of Fe further comprising at least one of said elements other than Fe, barium ferrite, and strontium



ferrite.

### C. The Inomata Reference

Inomata teaches spin-dependent tunneling for nanostructured ferromagnetic tunnel junctions in which an insulating nanostructured film made of layered hard ferromagnetic  $\text{Co}_{80}\text{Pt}_{20}$  nanoparticles dispersed in an insulating  $\text{SiO}_2$  matrix is sandwiched between two soft ferromagnetic electrodes, an  $\text{Fe}/\text{Co}_{80}\text{Pt}_{20}$  as a bottom electrode and a  $\text{Co}_9\text{Fe}$  as a top electrode. The junctions investigated have three tunnel barriers and exhibited tunnel magnetoresistance of 9% at room temperature with a small resistance at a low field. The charging energy of the particles with an average diameter of 7 nm is estimated to be 45 meV from the temperature dependence of the resistance. Coulomb blockade is not observed for the junctions because of the low junction resistance.

### D. Applicants' Response

As amended, the claimed invention is patentable over the supposed combination of Black with Inomata. Specifically, the prior art of record does not disclose or make obvious "a magnetic-field sensor device comprising: at least two electrodes; an insulating layer separating said at least two electrodes; and at least one layer of chemically-synthesized magnetic nanoparticles disposed at or above a level with said insulating layer, and disposed between said at least two electrodes," as claimed in amended claim 1 and similarly claimed in amended claim 11. Furthermore, Neither Black nor Inomata, nor a combination thereof disclose or make



obvious “a method of forming a magnetic-field sensor device, said method comprising: depositing a first electrode onto a substrate; depositing an electrically insulating layer on said first electrode; removing a portion of said electrically insulating layer to expose a region of said first electrode; depositing at least one layer of chemically-synthesized nanoparticles on said electrically insulating layer and said exposed region of said first electrode, wherein said at least one layer of chemically-synthesized nanoparticles is deposited at or above a level with said insulating layer; and depositing a second electrode on said chemically-synthesized nanoparticles and said electrically insulating layer,” as recited in amended claim 20, or “a method of forming a magnetic-field sensor device, said method comprising: depositing a first electrode onto a substrate; depositing an electrically insulating layer on said first electrode; depositing a second electrode on said electrically insulating layer; removing a portion of said electrically insulating layer to create an empty space; depositing at least one layer of chemically-synthesized nanoparticles in said empty space, wherein said at least one layer of chemically-synthesized nanoparticles is deposited at or above a level with said insulating layer; and removing said substrate,” as recited in amended claim 25. Such features are fully supported by the specification and drawings as originally filed and in particular are clearly shown in FIGs. 2A-2D, FIGs. 3A-3H, and FIGs. 4A-4G.

In fact, the figures and descriptions thereof in Black clearly show that the layer of nanoparticles are not at the level or above the level of the insulating layer. For example, in Figure 4 of Black, the nanoparticle layer 4A is below the insulating layer 7. Likewise, in Figure 5 of Black, the nanoparticles layers 4B and 4C are below the respective insulating layers 7B and

7C, respectively. In fact, column 8, lines 15-17 of Black clearly indicates that with respect to Figure 5, "a protective coating 7B [is] deposited between layers 4B and 4C of nm-scale particles 1." Thus, coating 7B must be above nanoparticles 4B and likewise coating 7C must be above nanoparticles 4C. Conversely, the claimed invention provides that the layer of chemically-synthesized magnetic nanoparticles is disposed at or above a level with the insulating layer. Thus, the structure and method of the claimed invention is functionally different and patentably distinct from Black.

Moreover, Inomata says nothing regarding whether the chemically-synthesized magnetic nanoparticles are disposed at or above a level with the insulating layer. In fact, page 1143, column 1, lines 17-20 of Inomata simply states that "an insulating nanostructured thin film made of layered hard ferromagnetic nanoparticles dispersed in an insulating matrix is sandwiched between two soft ferromagnetic electrodes." Thus, there is no teaching that the nanoparticles are at or above a level with the insulating layer. Furthermore, Figure 1 of Inomata is likewise bereft of any such teaching, and to view it otherwise would be erroneous.

Therefore, the claimed invention is patentably distinct from either Black or Inomata, whether taken alone or in combination with one another, and moreover, the invention is unobvious in light of the teachings of both Black and Inomata. Thus, claims 1-28 are patentably distinct over Black in combination with Inomata and are in condition for allowance. In view of the foregoing, the Examiner is respectfully requested to reconsider and withdraw this rejection.

#### IV. Formal Matters and Conclusion

Therefore, Applicants respectfully submit that amended independent claims 1, 11, 20, and 25 are patentable over Black, even if combined with Inomata. Furthermore, dependent claims 2-10, 12-19, 21-24, and 26-28 are similarly patentable, not only by virtue of their dependency from a patentable independent claim, but also by virtue of the additional features of the invention they define. In view of the foregoing, Applicants submit that claims 1-28, all the claims presently pending in the application, are patentably distinct from the prior art of record and are in condition for allowance. Furthermore, no new matter is presented. The Examiner is respectfully requested to pass the above application to issue at the earliest possible time.

Should the Examiner find the application to be other than in condition for allowance, the Examiner is requested to contact the undersigned at the local telephone number listed below to discuss any other changes deemed necessary. Please charge any deficiencies and credit any overpayments to Attorney's Deposit Account Number 09-0456.

Respectfully submitted,

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